

233/1
CHEMISTRY
PAPER 1
Time: 2 hours

KCSE 2023 TOP PREDICTION MASTER CYCLE
9

Name Index Number...../.....

Signature Date/...../.....

INSTRUCTIONS TO CANDIDATES

1. Write your name and index no in the spaces provided above.
2. Sign and write the date of exam in the spaces provided above.
3. Answer all the questions in the spaces provided after each.
4. Mathematical tables and silent electronic calculators may be used.
5. All working must be clearly shown where necessary.
6. This paper consists of 12 printed pages. Candidates should check to ensure that all pages are printed as indicated and that no questions are missing.
7. All answers should be written in English.

For Examiner's Use Only

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

17	18	19	20	21	22	23	24	25	26	27	28	29

**Grand
Total**

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1. Metal **Q** displaces metals **T** and **U** from their oxides but does not displace metal **R**. Metal **T** displaces **U** from its oxide. Arrange the metals according to their reactivity starting with the strongest reducing agent. (1 mark)

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2. Chlorine gas can be prepared in the laboratory using the following two methods;

Solid substance X and concentrated Hydrochloric acid

Solid substance X, concentrated sulphuric (VI) acid and solid Sodium Chloride.

- a) Name the solid substance X (1 mark)

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- b) What is the role of concentrated sulphuric acid in the reaction? (1 mark)

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- c) State how dry chlorine gas is collected. (1 mark)

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3. A white crystalline solid **Q** when heated forms a brown gas, colourless gas that relights a glowing wooden splint and a yellow residue which turns white on cooling. Aqueous solution of **Q** reacts with excess aqueous ammonia solution to form a colourless solution **P**.

- a) Write the name and chemical formulae of complex ion in solution **P**. (2 marks)

Name;

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Chemical formula;

.....

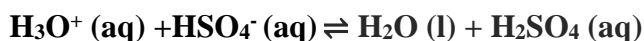
b) State the observation made when the aqueous solution of P is reacted with few drops of sodium hydroxide. (1 mark)

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4(a) Define an acid in terms of hydrogen ions. (1 mark)

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b) Study the reaction below and answer the questions that follow.



Identify the acid and base in the forward reaction. Explain. (2 marks)

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5. Ammonia gas is one of the substances recycled in the Solvay process.

a) Other than water name another substance that is recycled in the process. (1 marks)

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b) Write a balanced chemical equation for the reaction that regenerates Ammonia gas in the process. (1 mark)

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c) State an industrial use of the only waste product in the Solvay process. (1 mark)

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6. Lead (II) iodide is a toxic bright yellow solid which was used as a paint pigment known as 'iodine yellow'. Describe briefly how you would prepare lead (II) iodide in the laboratory starting with lead (II) oxide. (3 marks)

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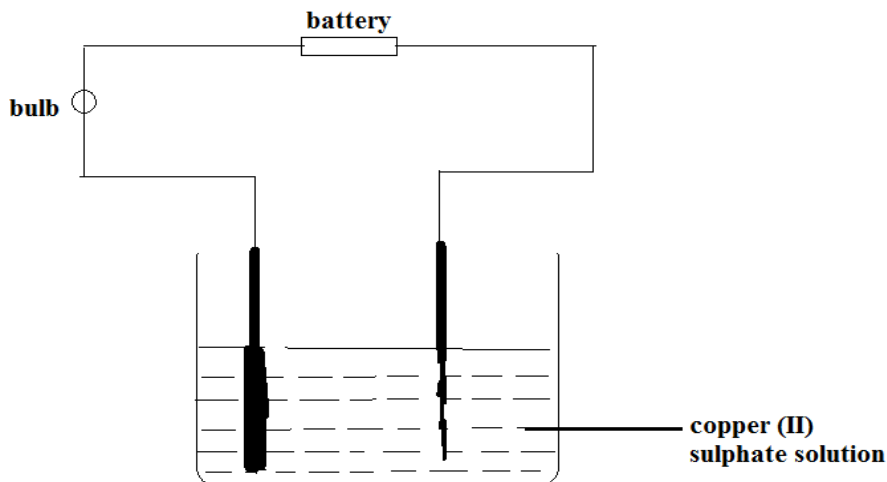
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7. 5.0g of zinc carbonate were allowed to react with 25cm³ of 1M hydrochloric acid until there was no further reaction. Calculate the volume of gas that was formed at s.t.p. (Zn = 65.4, O = 16, C = 12, molar gas volume at s.t.p = 22400 cm³) (3 marks)

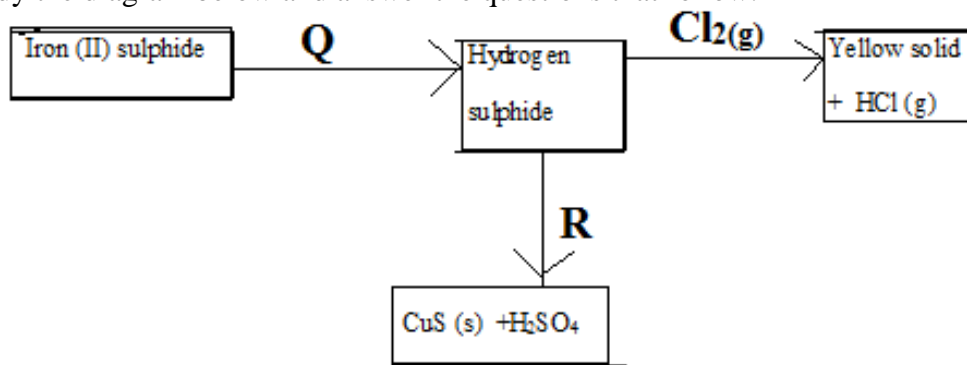
8. Atoms of element P can be represented as ${}_{11}^{23}\text{P}$. Element P reacts with sulphur to form a yellow solid. Using dots (•) and crosses (X) to represent electrons, draw the structure of the yellow solid. (S=16). (2 marks)

9. The set up below was used by a student to carry out the electrolysis of aqueous copper (II) sulphate using copper electrodes.



- a) On the diagram, label the anode and cathode. (1 mark)
- b) Write the half ionic equation for the reaction that undergoes oxidation. (1 mark)
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- c) Explain the observation made on the electrolyte when the copper electrodes are replaced with graphite electrodes. (1 mark)
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10. A fuel gas contains 50% of hydrogen gas and 44% of carbon (II) oxide by volume. The rest of is incombustible. Calculate the volume of gas that remains at room temperature when the 100 cm³ fuel gas was ignited. (3 marks)

11. Study the diagram below and answer the questions that follow.



- a) Name substances; (1 mark)
- Q
.....
- R
.....
- b) Write the equation for the reaction that leads to the formation of the yellow solid. (1 mark)
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- c) Using a chemical test, describe how you would distinguish between hydrogen sulphide and sulphur (IV) oxide. (1 mark)
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12. State **two** differences between luminous and non luminous flame of the Bunsen burner. (2 marks)
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13. A gas occupies a volume of 400cm³ at 227°C and 760mmHg. What will be the temperature of the gas when the volume and pressure of the gas is 100cm³ and 380mmHg respectively. (2 marks)

14. For each of the following experiments, give the observations, and the type of change that occurs (Physical or chemical) (3 marks)

Experiment	Observation	Type of change
A few drops of concentrated sulphuric acid added to small amounts of sugar		
A few crystals of Iodine are heated gently in a test tube		
A few crystals of copper (II) Nitrate are heated strongly in a test tube.		

- 15(a) Define solubility of a solute. (1 mark)

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- b) The solubility of potassium nitrate is 120g/100g of water at 80 °C and 70g/100g of water at 20°C. What mass of the salt would crystallize if 80g of potassium nitrate solution saturated at 80 °C was cooled to 20 °C? (2 marks)

16. Zinc metal reacted with dilute hydrochloric acid. The gas produced was then passed over heated copper (II) oxide in a combustion tube.
- a) State two precautions that must be considered when the gas reacts with copper (II) Oxide in the combustion tube. (2 marks)

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b) Write a balanced chemical equation between zinc and dilute hydrochloric acid. (1 mark)

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17. The table below shows ammeter readings recorded when two equimolar solutions were tested separately.

Electrolyte	Current (A)
Dilute Sulphuric (VI) Acid	7.210
Ethanoic Acid	4.011

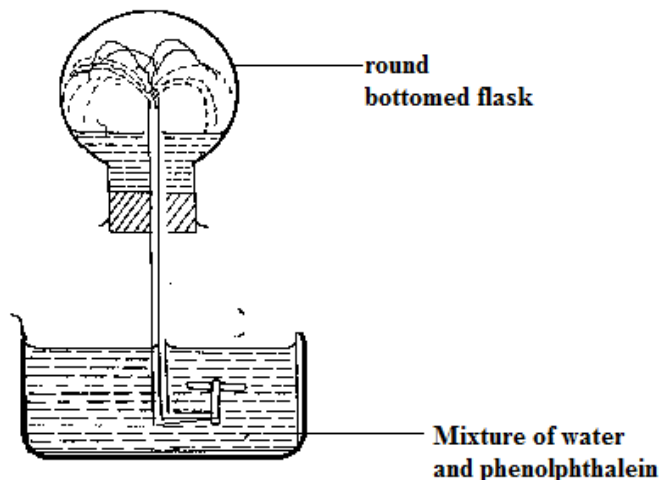
a) Explain the difference in the ammeter readings. (2marks)

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b) Compare the reactivity of equal length of magnesium ribbon with each of the electrolytes. (1 mark)

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18. The set up below was used to show the solubility of ammonia gas in water.



- (a) State and explain the observations made in the flask. (2 marks)

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- (b) Write a balanced equation to show how ammonia gas reacts with water. (1 mark)

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19. Magnesium ribbon was added to a solution of hydrogen chloride in methylbenzene. Another piece of Magnesium ribbon was added to distilled water. State and explain observations made. (2 marks)

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20. One of the disadvantages of hard water is wastage of soap.

- a) Write the chemical formula of a salt that causes permanent water hardness. (1 mark)

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- b) Given the chemical formula of soap as RCOONa . Write a balanced equation show how soap reacts with the salt stated in (a) above. (1 mark)

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c) State **two** advantages of water hardness. (1 mark)
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21. A piece of sodium was burnt in excess oxygen gas. The product obtained was shaken with water to make a solution.
(a) Write a balanced equation for reaction between the product formed and water. (1 mark)
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(b) State and explain the observation made when red and blue litmus papers are dipped into the solution. (2 marks)
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22. Aluminium chloride and sodium chloride are both chlorides of period 3 elements in the periodic table. Use this information to explain the following observations.
a) A solution of Al_2Cl_6 in water turns blue litmus paper red while that of sodium Chloride does not. (1½ marks)
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b) Sodium chloride has a melting point $801^\circ C$ is while Al_2Cl_6 sublimes $183^\circ C$. (1½ marks)

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23. The ionization energies of elements A and B are 495.9kJ/mol and 739.9kJ/ mol respectively. Both elements are in the same group of the periodic table.

a) What is ionization energy? (1 mark)

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b) Compare the reactivity of elements A and B . Explain your answer. (2 marks)

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24. Study the information given in the table below and answer the questions below.

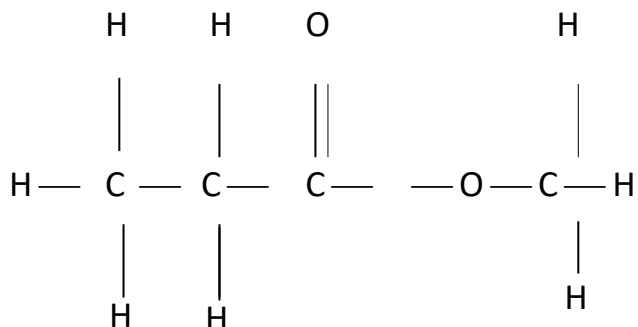
Bond	Bond energy(kJ/mol)
C-H	413
H-Cl	431
C-Cl	346
Cl-Cl	244
C - C	347

a) Calculate the enthalpy change for the reaction below.



b) State a condition required for the reaction in (a) above to take place. (1 mark)

25. Study the organic compound below:

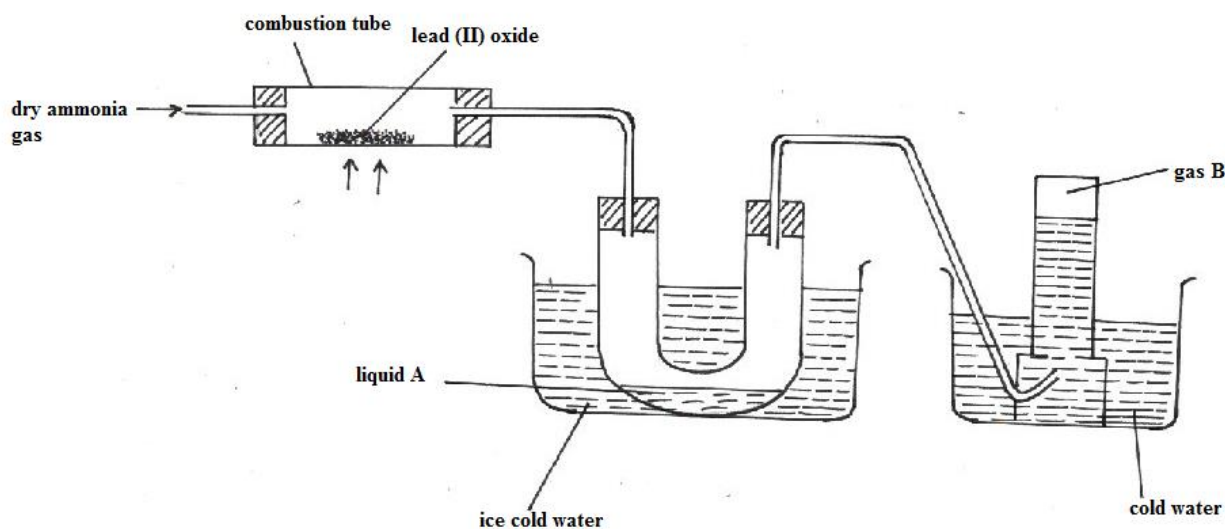


(a) In which homologous series does the compound belong to? (1 mark)

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(b) Name and draw the structures of two compounds that can be used to prepare the above compound. (3 marks)

26. The diagram below represents a set-up that can be used to obtain nitrogen gas in the laboratory. Use the information on the diagram to answer the questions that follow



(a) Describe the chemical test for liquid A. (1 mark)

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(b) What observation is made in the combustion tube during the reaction? (1 mark)

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(c) State two uses of gas B. (1 mark)

27. Analysis of an organic acid isolated from red ants shows that it contains 0.06 g of carbon, 0.01g of hydrogen and 0.16 g of oxygen.(H=1,O=16, C=12)

a) Calculate the empirical formula for this acid. (1½ marks)

b) What is the basicity of the acid if the empirical formula of the acid is the same as its molecular formula. (½ mark)

28. Nitrogen (IV) oxide dissolves and reacts with Sodium hydroxide solution to form two salts and water.

a) What is the nature of Nitrogen (IV) oxide? { 1 mark }

b) Write the Ionic equation for the reaction that takes place. { 1 mark }

29. When powdered brass was reacted with excess dilute sulphuric (VI) acid, a solid residue was left.

(i) Name the residue. (1 mark)

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(ii) Explain why the residue was left. (1 mark)

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(iii) State another observation made (1 mark)

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